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## (54) Semiconductor memory device having bit line sense amplifier array

(57) A semiconductor memory device comprises a bit line sense amplifier array composed of K bit line sense amplifiers 11 divided into  $2^n$  in a column direction,  $K/2^n$  local data bus lines held in common on the bit line sense amplifier array of the same column direction and displaced to pass over a cell array and the bit line sense amplifier array, a sub column decoder 15 connected to the bit line sense amplifier array so that one bit line sense amplifier per  $2^n$  bit line sense amplifiers on each bit line sense amplifier array can be connected with the local data bus lines, a switch being so that the bit line sense amplifier selected by an output of the  $2^n$  sub column decoders per each bit line sense amplifier array can be connected with the local data bus line, and  $K/2^n$  data bus sense amplifiers 12 connected to the  $K/2^n$  local data line to pre read  $K/2^n$  bit line amplifier data selected by the column decoder output. Further aspects relate to semiconductor memory devices having burst read operation, a sense amplifier array composed of  $m \times n$  data bus sense amplifiers and  $m \times n$  write data drivers for  $m \times n$  local data buses. A further embodiment is described (Fig 4). Examples of sub column decoders are described (Figs 6A, 6B) as are examples of read and write data paths (Figs 7-10).

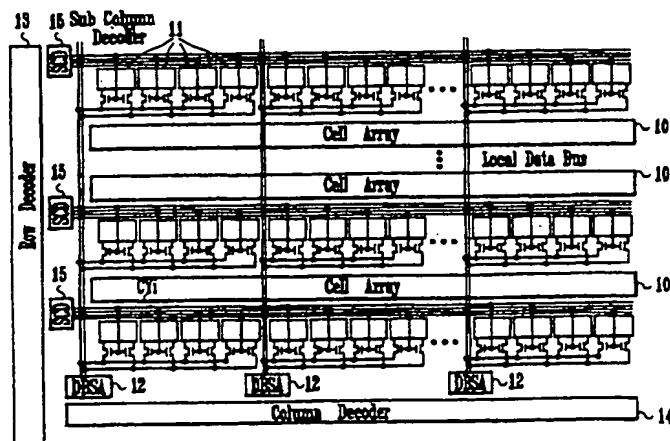


Fig . 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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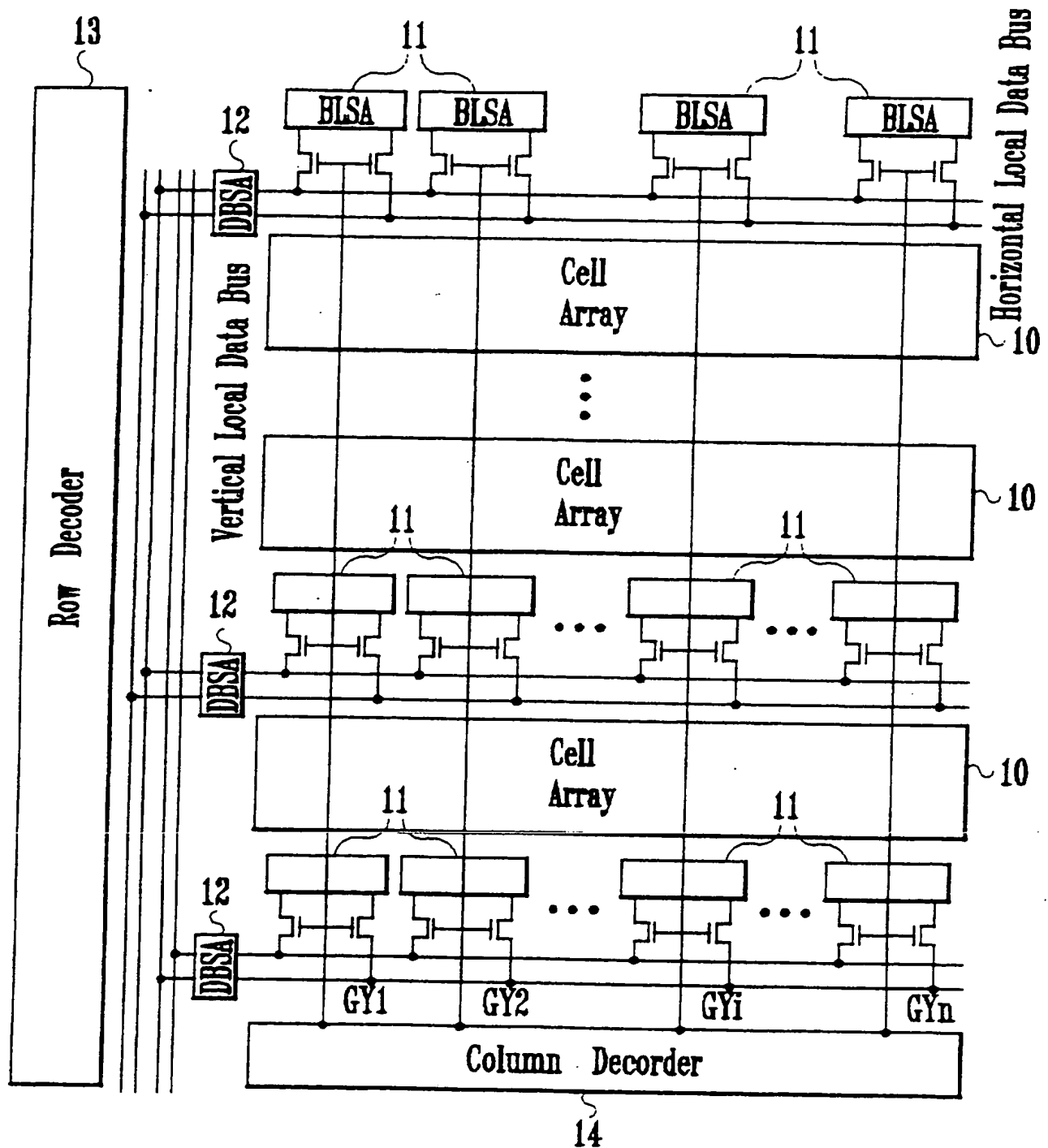


Fig . 1 (Prior Art)

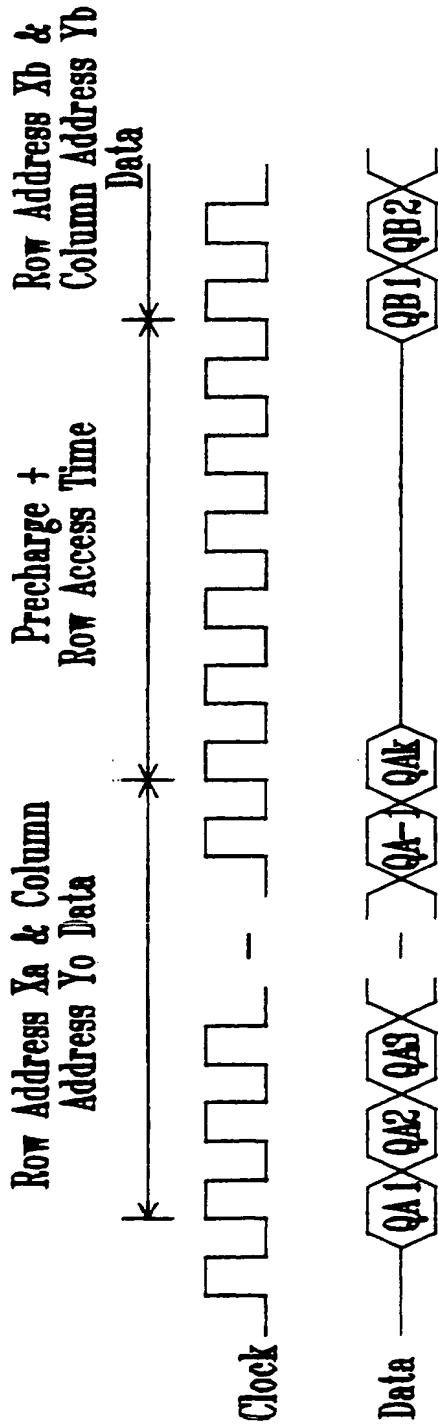


Fig . 2  
(Prior Art)

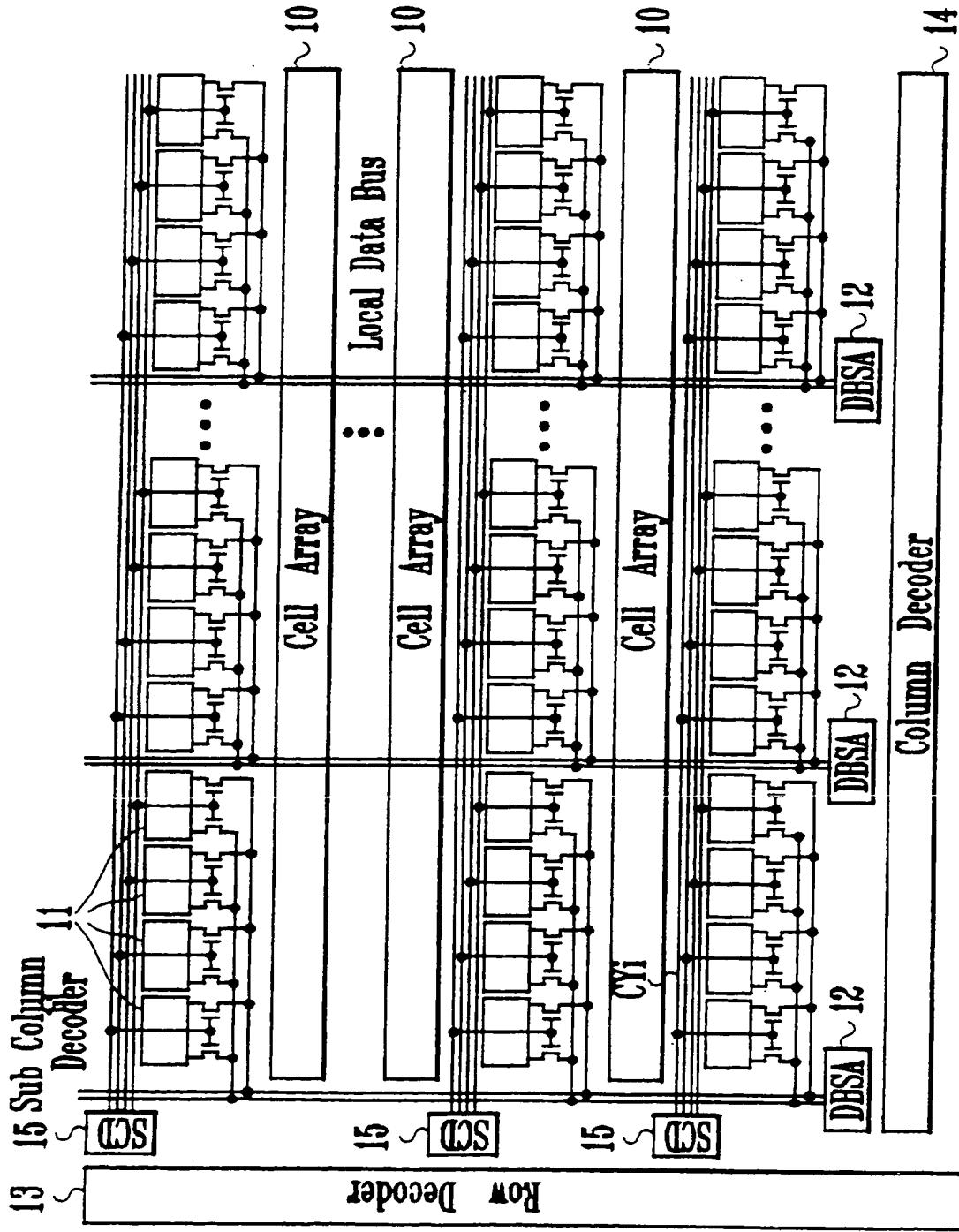


Fig. 3

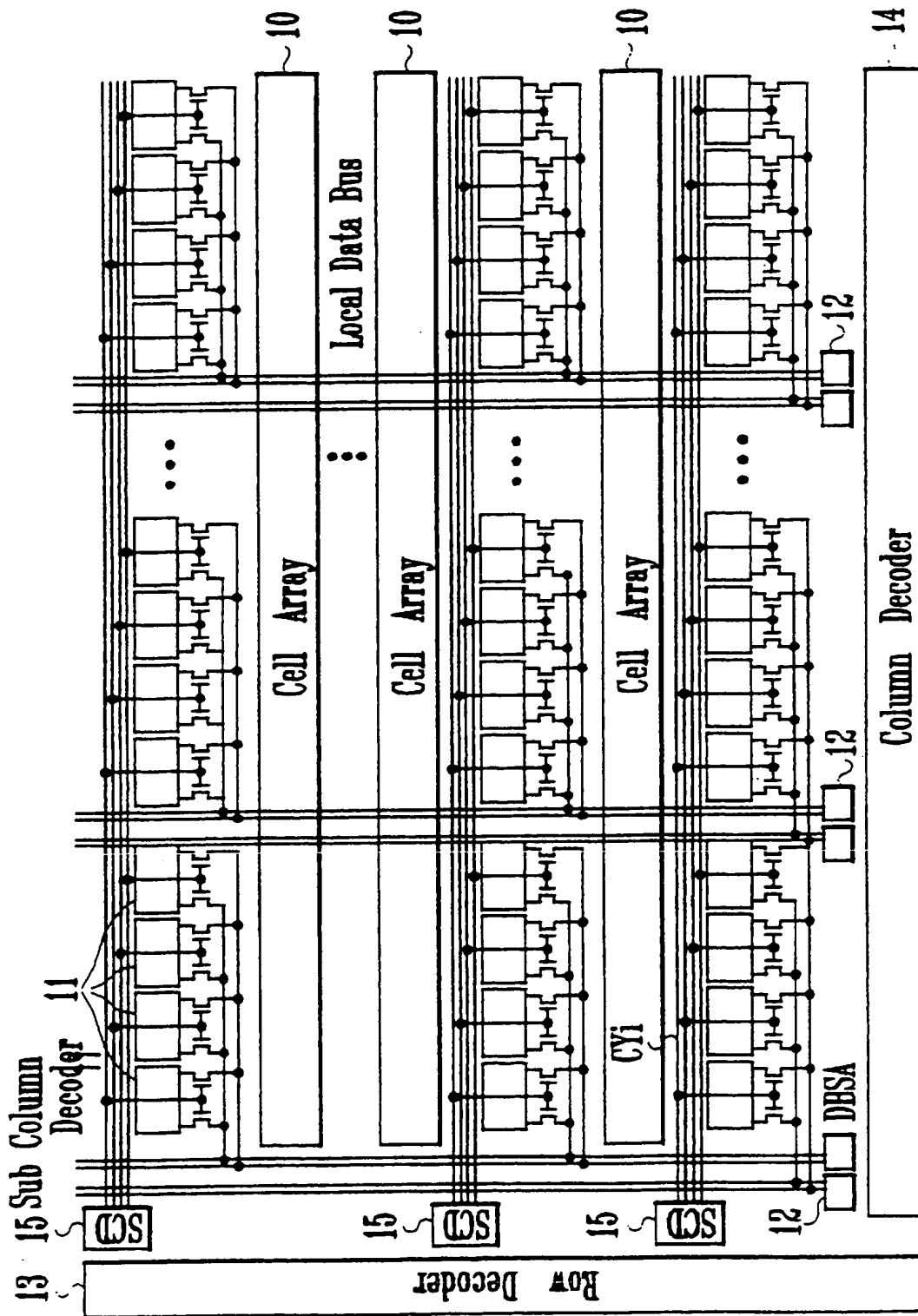


Fig. 4.

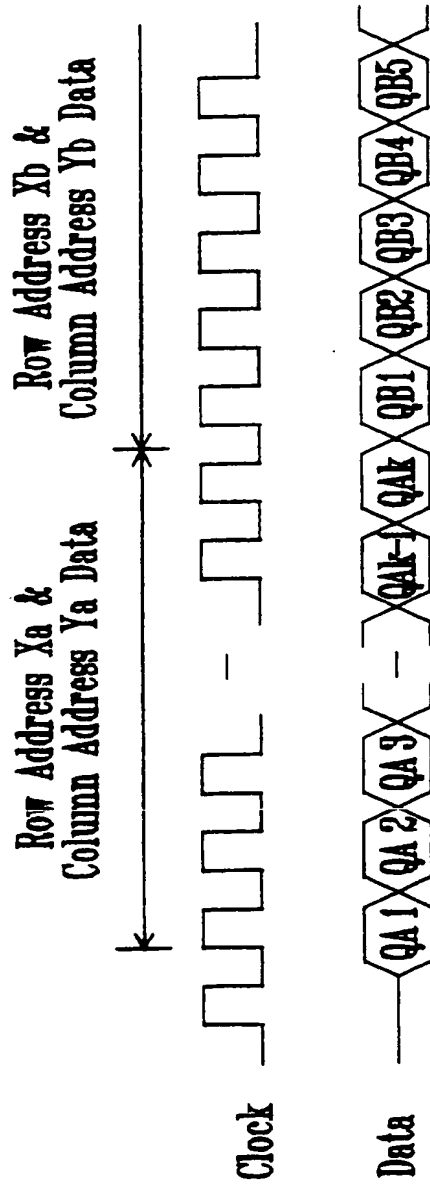


Fig . 5

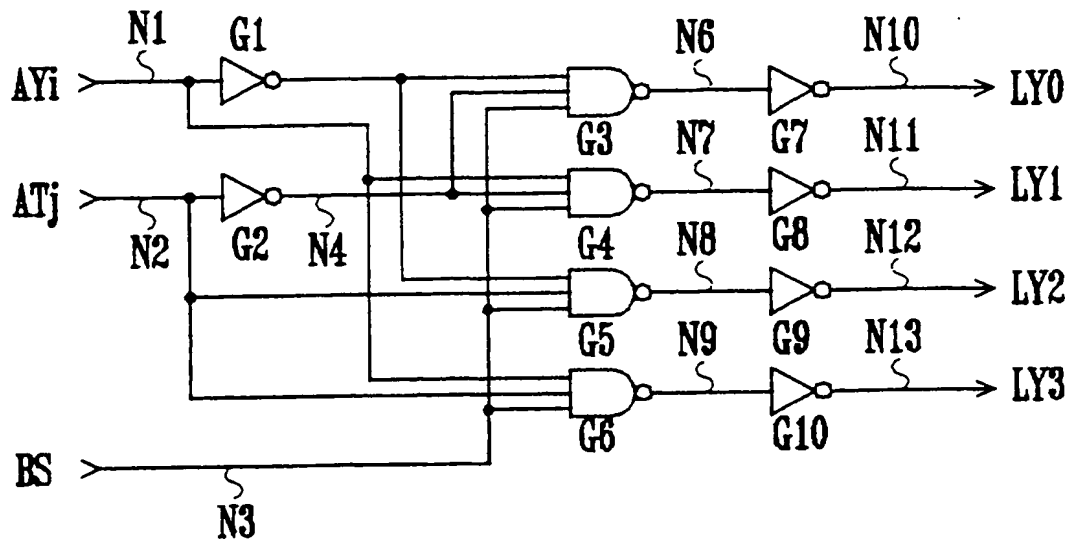


Fig . 6A

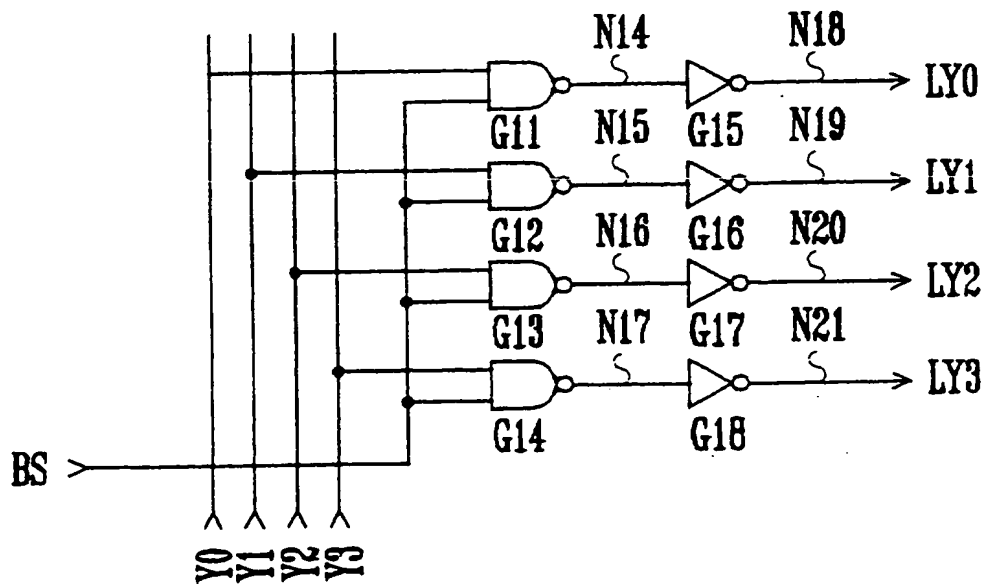


Fig . 6B

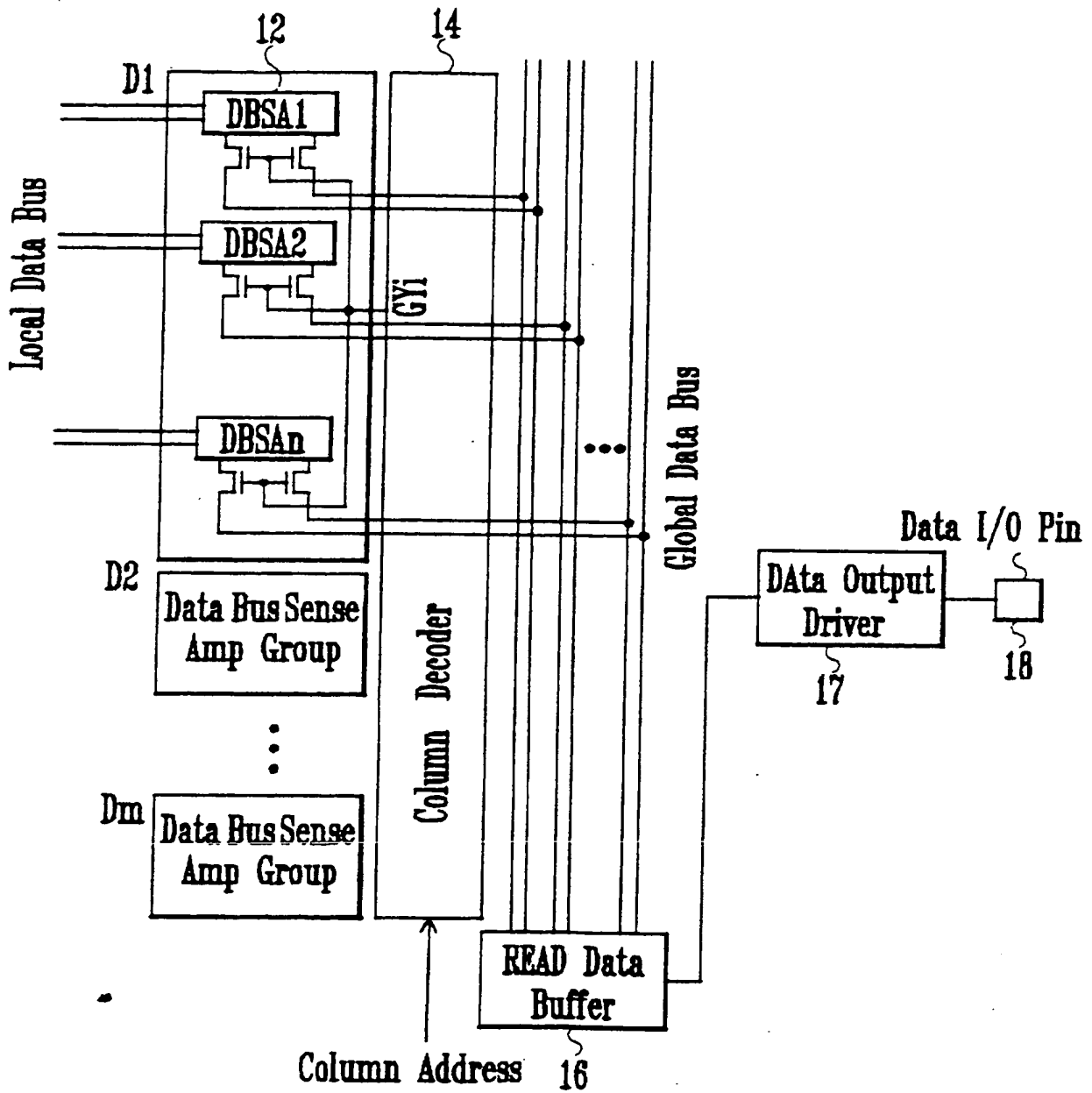


Fig . 7



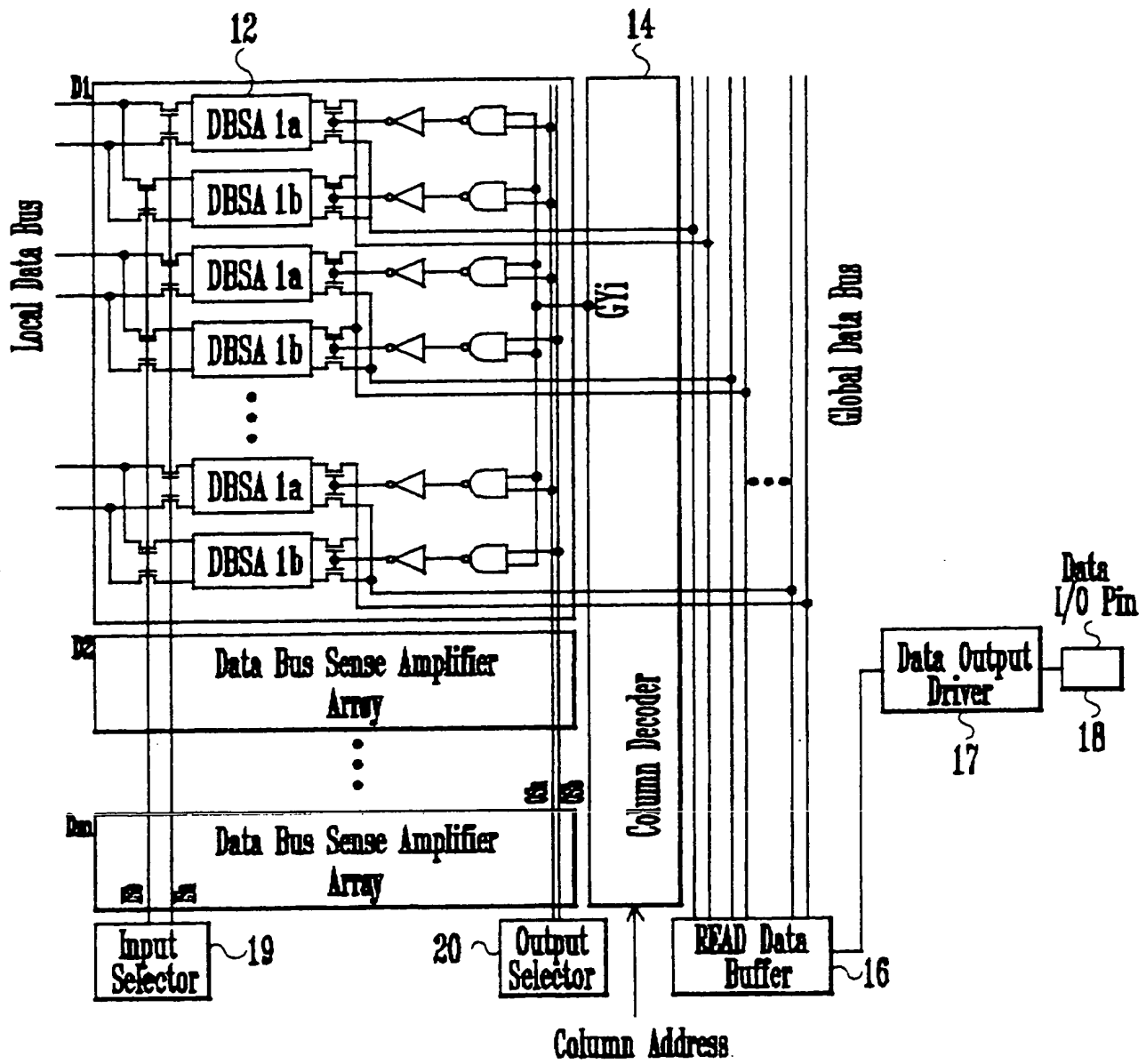


Fig. 8

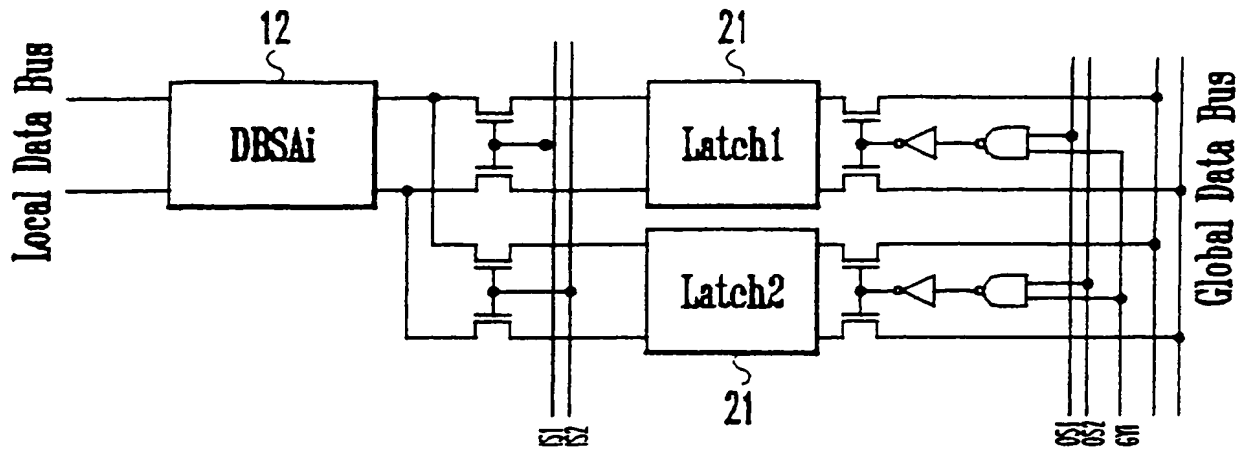


Fig. 9A

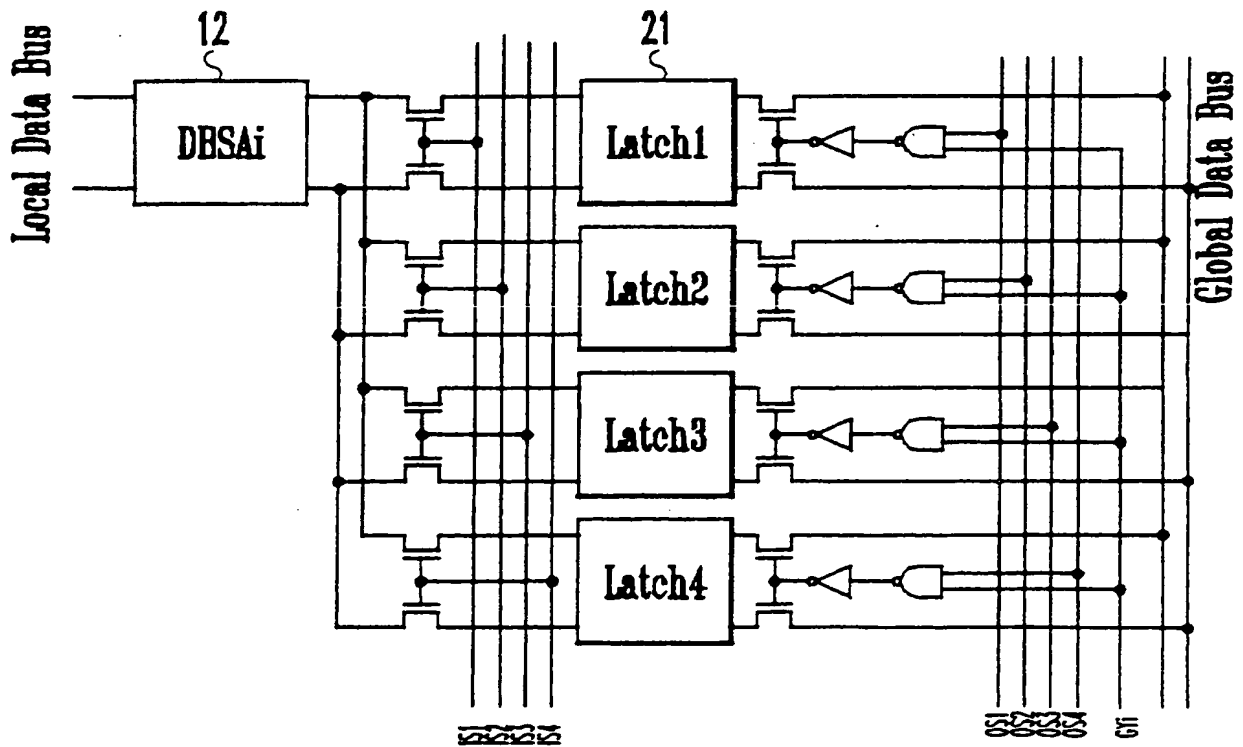


Fig. 9B

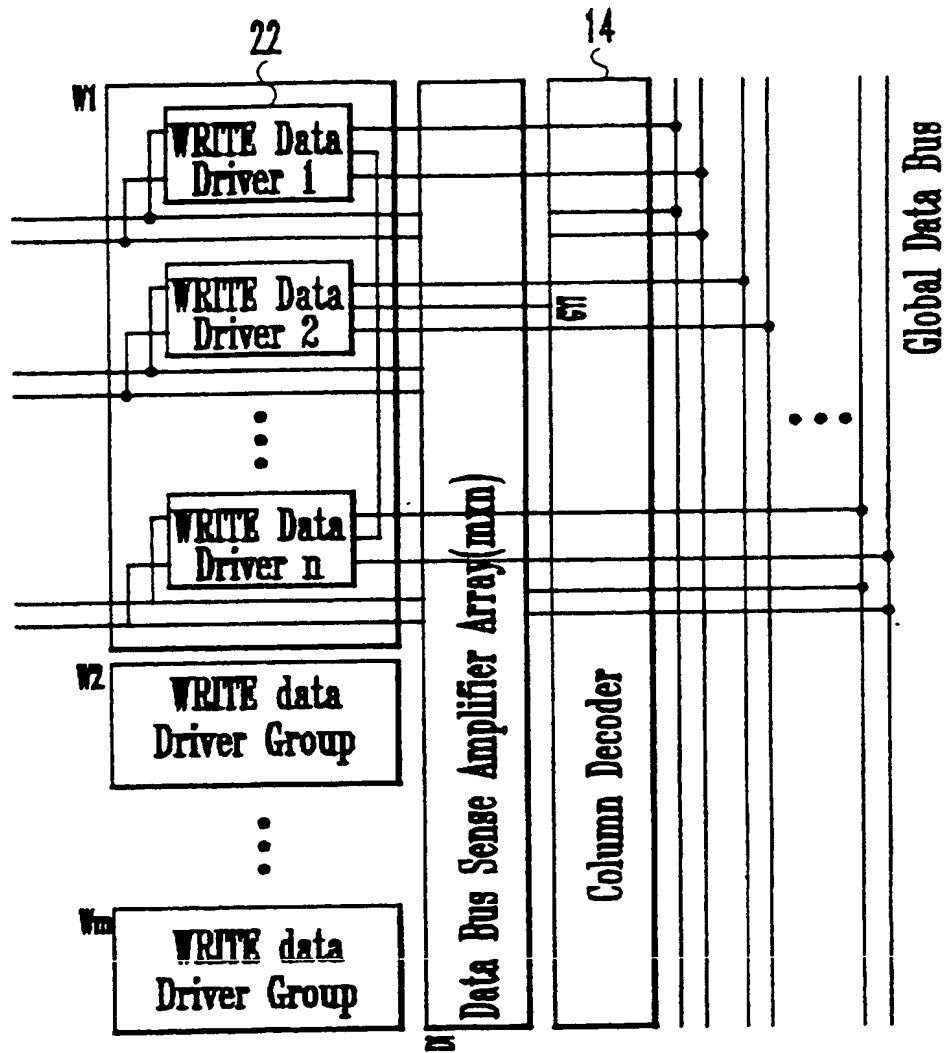


Fig. 10

## A SEMICONDUCTOR MEMORY DEVICE WITH INCREASED BANDWIDTH

## BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a semiconductor memory device having a data bus line structure suitable for a high-speed burst read/write operation and, more particularly, to a semiconductor memory device with increased bandwidth capable of operating a high-speed burst read/write by displacing to pass a plurality of data buses over a cell array and sense amplifier array and pre-reading data of a plurality of sense amplifiers in a local data bus sense amplifier at the same time.

15 Description of the Prior Art

In general, in comparison to an operative speed of a microprocessor, since state memory operation is at a low-speed, it is limited to improve an efficiency in the overall system. Recently, it has been found that a remarkable rambus DRAM or high-speed synchronous DRAM (hereinafter referred to SDRAM) considerably increases a bandwidth (herein, a bandwidth is a bus operative frequency x a data bus width) and an operative speed as compared to a conventional Dynamic Random Access Memory (hereinafter, 'DRAM'). However, various problems are expected to embody a rambus DRAM or a high-speed SDRAM for a gigabit DRAM. One of the problems is that a READ/WRITE data bus structure doesn't satisfy required conditions of a high-speed/high-bandwidth as a current data bus structure.

A conventional local data bus structure is composed of a horizontal local data bus and vertical local data bus in which only a portion of data stored in a Bit Line Sense Amplifier (hereinafter referred to a 'BLSA') array is transferred to a Data Bus Sense Amplifier (hereinafter referred to 'DBSA') through a horizontal local data bus by means of GYi signal, that is, an output signal of a main column decoder past over a cell array on a metal line, and

a data sensed in DBSA is transferred to a Global Data Bus through a vertical local data bus. On the other hand, a vertical local data bus is displaced over a Sub Word Line Driver essentially capable of alleviating a metal pitch after 64 Mb DRAM, therefore, limiting the number of accessible BLSA simultaneously. Additionally, the greater the improvement of an integrated degree of a memory is, the longer the length of GYi signal line is, as a result, it is a restricted element for decreasing a column access time.

Hereinafter, the present invention will be described in detail with reference to a semiconductor memory device having a conventional data bus structure shown in Fig. 1.

A BLSA selected by as GYi signal of an output signal of a column decoder transfers a data to a horizontal local data bus, and a DBSA stores by sensing a transferred data. A data stored in DBSA is transferred to a global data bus through a vertical local data bus. Accordingly, in a conventional local data bus structure, the number of BLSA is limited to 2 to 4, simultaneously being accessed at every active word line.

Fig. 2 is a conventional burst READ timing view to 2 continuous row addresses (Xa & Xb).

In a current SDRAM, there is required a precharged row access time between a burst data (QAi,  $1 \leq i \leq k$ ) by means of a row address Xa and a column address Ya and a burst data (QBi,  $1 \leq i \leq k$ ) by means of a row address Xa and a column address YB in the case that access to 2 row addresses (Xa & Xb) is continuously performed in the same bank, therefore, deteriorating a burst read efficiency of DRAM.

#### SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a

semiconductor memory device having a data bus line structure suitable for a high-speed burst read/write operation that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

5

An object of the present invention is to provide a semiconductor memory device having a data bus line structure suitable for a high-speed burst read/write operation capable of operating a high-speed burst read/write displacing to pass a plurality of data buses over a cell array and sense amplifier array and pre-reading data of a plurality of sense amplifier in a local data bus sense amplifier at the same time.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practices of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a semiconductor memory device, said device comprising: a bit line sense amplifier array composed of  $K$  bit line sense amplifiers divided into  $2^n$  in a column direction;  $K/2^n$  local data bus lines held in common on said bit line sense amplifier array of said same column direction and displaced to pass over a cell array and said bit line sense amplifier array; a sub column decoder connected to said bit line sense amplifier array so that one bit line sense amplifier  $2^n$  bit line sense amplifiers on said each bit line sense amplifier array can be connected with said local data bus lines; a switch means being so connected with said local data bus lines; a switch means being so said bit line sense amplifier selected by an output of said  $2^n$  sub column decoders per said each

bit line sense amplifier array can be connected with said local data bus line; and  $K/2^n$  local data lines to pre-read  $K/2^n$  bit line sense amplifier selected by said column decoder output.

5 In another aspect, the present invention provides a semiconductor memory device, said device comprising: a bit line sense amplifier array composed of  $K$  bit line sense amplifiers divided into  $2^n$  in a column direction; all  $2K/2^n$  local data bus lines having said bit line sense amplifier group of the same column  
10 direction every array in common and displaced to pass over a cell array and said bit line sense amplifier array; a sub column decoder connected to both sides of said cell array so that one bit line sense amplifier per  $2^n$  on said each bit line sense amplifier array can be connected with said local data bus line;

15 a switch means so that said bit line sense amplifier selected by an output of said  $2^n$  sub column decoders per said each bit line sense amplifier array can be connected with said local data bus line; and  $2K/2^n$  bus sense amplifiers connected to said  $2K/2^n$  local  
20 data lines to pre-read  $2K/2^n$  bit line sense amplifier data selected by said column decoder output.

25 In another aspect, the present invention provides a semiconductor memory device for performing a burst read operation for 2 continuous row addresses, said device comprising: a data of said previous row address being pre-read in said data bus sense amplifier, next burst read operation being continuously performed after first burst read by performing access to data of said next row address through precharged state during a burst read operation,  
30 in order to perform a continuous burst read operation without interrupting between burst data by means of a previous row address and a next row address.

35 In another aspect, the present invention provides a semiconductor memory device having a data bus sense amplifier array

composed of  $m \times n$  data bus sense amplifiers said device comprising:  
one block being divided into  $m$  data bus sense amplifier block by  
regarding  $n$  data bus sense amplifiers holding an output of a column  
decoder in common as one clock;  $n$  bit line sense amplifiers  
5 pertaining to said data bus sense amplifier block transferring the  
stored data by being simultaneously connected to  $n$  global data  
buses by an output of said column decoder; and said transferred  
data having a data read path transferred to a data pin through a  
data output driver after it is received on a read data buffer.

10 In another aspect, the present invention provides a  
semiconductor memory device having a data bus sense amplifier array  
composed of  $m \times 2n$  data bus sense amplifiers, said device comprising:  
one block being divided into  $m$  data bus sense amplifier block by  
15 regarding  $2n$  data bus sense amplifiers holding an output of an  
column decoder in common as one block;  $n$  data bus sense amplifiers  
among  $2n$  bit line sense amplifiers pertaining to said data bus  
amplifier block transferring the stored data by being  
simultaneously connected to  $n$  global data buses by means of the  
20 output of said column decoder and an output selector; and said  
transferred data comprising a data read path transferred to a data  
pin through a data output driver after it is received on a read  
data buffer.

25 In another aspect, the present invention provides a  
semiconductor memory device, having  $m \times n$  write data drivers for  $m$   
 $\times n$  local data buses, wherein  $n$  write data drivers holding an  
output of a column decoder in common are divided into  $m$  write data  
driver blocks by becoming one block,  $n$  write data drivers  
30 pertaining to said write data driver block continuously perform a  
write operation by being simultaneously connected to a global data  
bus by means of said column decoder and driving to a local data bus  
data transferred through said global data bus from a data pin.

35 It is to be understood that both the foregoing general



description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

5

#### BRIEF DESCRIPTION OF THE ATTACHED DRAWINGS

The accompanying drawings, which are included to provide further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the drawings:

In the drawings:

Fig. 1 is a circuit view of a DRAM having a conventional data bus structure.

15 Fig. 2 is a conventional burst read timing view to 2 continuous row addresses.

Fig. 3 is a circuit view of a DRAM having a data bus line structure suitable to a burst read/write operation by means of the first embodiment of the present invention/

20 Fig. 4 is a circuit view of DRAM having a data bus line structure suitable for a high-speed burst read/write operation by means of the second embodiment of the present invention.

Fig. 5 is a timing view of a burst read according to the present invention to 2 continuous row addresses.

25 Fig. 6A is the first embodiment circuit view of a sub column decoder shown in Figs. 3 and 4.

Fig. 6B is the second embodiment circuit view of a sub column decoder shown in Figs. 3 and 4.

30 Fig. 7 is a circuit view showing a first embodiment of a data read path of the present invention.

Fig. 8 is a circuit showing a second embodiment of a data read path of the present invention.

Fig. 9A is a circuit view showing a third embodiment of a data read path of the present invention.

35 Fig 9B is a circuit view showing a fourth embodiment of a data

read path of the present invention.

Fig. 10 is a circuit view showing an embodiment of a data write path of the present invention.

## 5 DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

10

Fig. 3 is a circuit view of a DRAM having a data bus line structure suitable to a burst read/write operation by means of a first embodiment of the present invention. Each BLSA 11 array is divided into  $2^n$  in the column direction and there is a structure displacing local data buses of the respective 1 pair (2 lines) above the array.

15

Each BLSA 11 array is divided into 4 ( $=2^2$ ) in Fig.3 and it can be divided into 1 ( $=2^0$ ), 2 ( $=2^1$ ), 8 ( $=2^3$ ) if necessary. Each local data bus (composed of 2 lines), is used in common in BLSA 11 group of in the same column direction, passes over a cell array 10, only a BLSA 11 selected by an output signal, LiYi, of a Sub Column Decoder (hereinafter 'SCD') 15 passing through a horizontal direction is connected with a local data bus. A data transferred direction is connected with a local data bus. A data transferred to a local data bus is latched after being sensed by DBSA 12 connected to the respective local data bus. Herein, DBSA 12 is composed of a portion of sensing a data loaded on a local data bus and a portion of latching a data, which performs the function of a kind of cache memory. (The circuit of DBSA 12 can be embodied by various methods, therefore, this application doesn't provide a specific circuit.)

25

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Accordingly, when the number of cells connected to word line is 2K, simultaneously a data stored on BLSA 11 array is prefetched

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on DBSA of  $K/2^n$  through a local data bus of  $K/2^n$  ( $K/4$  in Fig. 3). Then, only a data of DBSA 12 designated by the output of a column decoder 14 is transferred to a data output driver through a global data bus.

5

In a conventional data bus structure, since necessary data is stored on BLSA array, a necessary BLSA 11 is selected by a GYi signal, that is, an output of a main column decoder and of a long metal line. Then, column access time becomes longer because of reading a data through a long vertical local data bus. However, in the present invention, a necessary data is prefetched on DBSA 12 array adjacent to the column decoder 14, and access to a column can be quickly performed and a high-speed burst read operation can be performed.

10

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Fig. 4 is a circuit view of DRAM having a data bus line structure suitable for high-speed burst read/write operation by means of the second embodiment of the present invention. Each BLSA 11 array is divided into  $2^n$  in the column direction, and a structure displacing a local data bus at every 2 pair (4 lines) over each array.

20

In Fig. 4, each BLSA 11 array is divided into  $4 (=2^2)$ , and can be divided into  $2 (=2^1)$ , or  $8 (=2^3)$  if necessary. The local data bus of 2 pairs passes over a cell array, and is used in common at every BLSA 11 group of the same column direction.

25

Only BLSA selected by an output (LYi) of a Sub Column Decoder (SCD) 15 passing a horizontal direction is connected to a local data bus. Fig. 3 shows activation of one SCDs 15 of a cell array 10 pertaining to an access word line, but Fig. 4 shows activating simultaneously both SCDs. That is, since data on both BLSA arrays of a cell array an activated word line pertains to are latched, the embodiment of Fig. 3 which a local data bus is used in common

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activates only SCD of one side, the embodiment of Fig. 4 which local data bus is divided into 2 pairs. Data transferred to a local data bus are latched after being sensed by DBSA 12 connected to each local data bus.

5

Accordingly, when the number of cells connected to a word line 2K, data stored on BLSA array through a local data bus of  $2K/2^n$  ( $2K/4$  in Fig. 4) are prefetched on DBSAs of  $2K/2^n$ . Then, only data of DBSA 12 selected by an output  $GY_i$  of a column decoder 14 are transferred to a data output driver through a global data bus.

10

Fig. 5 is a burst read timing device of the present invention to 2 continuous row addresses. Different from a conventional timing view (Fig. 2), a burst read operation is possible continuously without interruption between burst data ( $QA_i, 1 \leq i \leq k$ ) by means of a row address  $X_a$  and a column address  $Y_a$ , and burst data ( $QB, 1 \leq i \leq k$ ) by means of a row address  $X_b$  and a column address  $Y_b$ .

15

This is because access to the data of the row address  $X_b$  can be performed through a precharged state after the data of the row address  $X_a$  is prefetched on DBSA array. Since the burst read operation described above is possible in the case that access to a row address is continuously performed, it doesn't deteriorate the efficiency due to access to a continuous row address.

20

25

Fig. 6A is the first embodiment circuit view of a sub column decoder shown in Figs. 3 and 4, which is composed of a first, second node  $N_1, N_2$  receiving column address signals  $AY_i, AY_j$ , a third node  $N_3$  receiving a block selective signal  $BS$ , an inverter  $G_1$  connected between the first node  $N_1$  and a fourth node  $N_4$ , an inverter  $G_2$  connected between the second node  $N_2$  and a fifth node  $N_5$ , a NAND gate  $G_3$  transferring to a sixth node  $N_6$  by NAND-counting signals of the 4, 5, 3 nodes  $N_4, N_5, N_3$ , and NAND gate  $G_4$  transferring to a seventh node  $N_7$  by NAND-counting signals of the 1, 5, 3 nodes

30

35

N1,N5,N3, a NAND gate G6 transferring to a ninth node N9 by NAND-counting signals of the 1,2,3 nodes N1,N2,N3, an inverter G7 connected to between the sixth node N6 and a tenth node N10 transferring LY0 signal an output of a sub column decoder, an inverter G8 connected to between the seventh node N7 and an eleventh node N11 transferring LY1 signal of an output of a sub column decoder, an inverter G9 connected to between the eight node N8 and a twelfth node N12 transferring LY2 signal an output of a sub column decoder, and an inverter G10 connected to between the ninth node N9 and a thirteenth node N13 transferring LY3 signal of an output of a sub column decoder.

When each BLSA array is divided into  $2^n$ , column addresses of the number of n are received, resulting in producing  $LY_i$  ( $0 \leq i \leq 2^n - 1$ ). It is selective to operate a sub column decoder (SCD) which receives a block selective signal (BS) activated of a selected cell array.

Fig. 6B is the second embodiment circuit view of a sub column decoder shown in Figs. 3 and 4, which is composed of a NAND gate G11 transferring to a fourteenth node N14 the NAND-counting value by receiving an address signal Y0 and block selective signal BS, a NAND gate G12 transferring to a fifteenth node n15 and NAND-counting value by receiving an address signal Y1 and block selective signal BS, a NAND gate G13 transferring to a sixteenth node N16 the NAND-counting value byh receiving an address signal Y2 and block selective signal BS, a NAND gate G14 transferring to a seventeenth node N17 the NAND-counting value by receiving an address signal Y3 and block selective signal BS, an inverter G15 connected between the fourteenth node N14 and an eighteenth node N18 transferring an output signal LY0 of a sub column decoder, an inverter G16 connected between the fifteenth node N15 and a nineteenth node N19 transferring an output signal LY1 of a sub column decoder, an inverter G17 connected between the sixteenth node N16 and a twentieth node N20 transferring an output signal LY2

of a sub column decoder, and an inverter G18 connected between the seventeenth node N17 and a twenty-first node N21 transferring an output signal LY3 of a bus column decoder.

5           If each BLSA array is divided into  $2^n$ ,  $n$  column addresses are decoded, resulting in producing  $Y_i$  ( $0 \leq i \leq 2^n - 1$ ). All sub column decoders (SCD) hold a column decoder output  $Y_i$  in common. A sub column decoder regarding an activated BS signal of a cell array selected as an input signal operates by receiving a column decoder  
10       output signal  $Y_i$  ( $0 \leq i \leq 2^n - 1$ ) as an input.

Fig. 7 is a circuit view showing a first embodiment of a data read path of the present invention.

15           The overall data base sense amplifier DBSA array (DBSA of the number  $m \times n$ ) is divided into  $m$  DBSA blocks  $D_i$  ( $1 \leq i \leq m$ ) by  $n$  DBSAs holding an output  $GY_i$  of a column decoder 14 in common. Accordingly,  $n$  DBSAs among  $2n$  BLSAs send the stored data by being simultaneously connected to a global data bus by means of  $GY_i$  and  
20       OS signals. The transferred data is sent to a data pin 18 through a data output driver 17 after being received by a read data buffer 16.

Fig. 8 is different from Fig. 7 in that the connection is  
25       controlled by an input selector 19 and output selector 20 since each local data bus has 2 DBSAs. That is, since each DBSA block has two DBSA groups divided into an  $a$  group and  $b$  group, the prefetch operation is performed from a local data bus to DBSA array in parallel with connecting to a global data bus from DBSA array.  
30       While READ operation for one DBSA group is performed, the other DBSA group can read data in a Full Page Mode by receiving a data from a local data bus without collision of data. (Full Page Mode is a mode which reads/writes all cell data connected to a word line.)

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Fig. 9A, which is a circuit view showing a third embodiment of a data read path of the present invention, shows only the distinguished DBSA portion except the portion identical to Fig. 8.

5 In Fig. 8, each local data bus has 2 DBSAs, while in Fig. 9A, the connection is controlled by  $IS_i$  ( $i=1,2$ ) and  $OS_i$  ( $i=1,2$ ) signal since each DBSA has 2 latches 21.

10 Just like Fig. 8, the prefetch operation can be performed from a local data bus to a latch array in parallel with connecting to a global data bus from a latch array. That is, the prefetch operation is performed since one latch of two latches is connected to each DBSA by  $IS_i$  signal, and the other latch is connected to a global data bus by  $OS_i$  signal.

15 Fig. 9B is a circuit view showing a fourth embodiment of a data read path of the present invention. The connection of read operation is controlled by  $IS_i$  ( $i=1,2,3,4$ ) and  $OS_i$  ( $i=1,2,3,4$ ) signal since each DBSA has 4 latches.

20 Similarly, the prefetch operation can be performed from a local data bus to a latch array in parallel with connecting to a global data bus from a latch array.

25 Fig. 10 is a circuit view showing an embodiment of a data write path of the present invention.

30 Since there are  $mn$  Write Data Drivers (WDD) for  $mn$  local data buses, by  $n$  WDDs having  $GY_i$  signal of an output signal of a column decoder in common,  $mn$  local data buses are divided into  $m$  WDD blocks  $W_i$  ( $1 \leq i \leq m$ ).

35 Accordingly,  $n$  WDDs pertaining to  $m$  WDD blocks  $W_i$  perform a write operation by being simultaneously connected to a global data bus by means of  $GY_i$ , and driving the transferred data to a local

data bus.

As described above, if a semiconductor memory device having a data bus line structure suitable for a high-speed burst read/write operation of the present invention is applied to a super-high integrated memory device of gigabit degree, data can be continuously read without interrupting between burst data when access to 2 continuous row address can be performed if a burst length is enough long. Therefore, it is possible to improve the efficiency of a burst read, and prefetch a plurality of data on DBSA array adjacent to a column decoder by means of a local data bus displaced in a metal line over a cell array. As a result, a column address can operate quickly (a prefetch means what is previously latching a bundle of data to be output). A high channel width burst read/write operation can be performed by being applied to data bus structure of SDRAM without increasing the area of a chip.

It will be apparent to those skilled in the art that various modification and variations can be made in a semiconductor memory device having a data bus line structure suitable for a high-speed burst read/write operation of the present invention without departing from the spirit and scope of the invention. Thus, it is intended that the present invention cover the modification and variation of this invention provided that they come within the scope of the appended claims and their equivalents.



WHAT IS CLAIMED IS:

1. A semiconductor memory device, said device comprising:  
a bit line sense amplifier array composed of K bit line sense  
5 amplifiers divided into  $2^n$  in a column direction;

$K/2^n$  local data bus lines held in common on said bit line  
sense amplifier array of said same column direction and displaced  
to pass over a cell array and said bit line sense amplifier array;

a sub column decoder connected to said bit line sense  
10 amplifier array so that one bit line sense amplifier per  $2^n$  bit  
line sense amplifiers on said each bit line sense amplifier array  
can be connected with said local data bus lines;

a switch element being so that said bit line sense amplifier  
selected by an output of said  $2^n$  sub column decoders per said each  
15 bit line sense amplifier array can be connected with said local  
data bus line; and

$K/2^n$  data bus sense amplifiers connected to said  $K/2^n$  local  
data lines to pre-read  $K/2^n$  bit line amplifier data selected by  
said column decoder output.

2. The semiconductor memory device according to claim 1, wherein  
when said bit line sense amplifier array composed of said K bit  
line sense amplifiers is divided into  $2^n$  in a column direction, n  
is an integral number greater than or equal to 0.

3. The semiconductor memory device according to claim 1, wherein  
said bus column decoder is selected by a block selective signal  
when said bit line sense amplifier array composed of K bit line  
sense amplifiers is divided into  $2^n$ , and decoded by receiving n  
30 column addresses as an input.

4. The semiconductor memory device according to claim 1, wherein  
said switch means are selected by a block selective signal when  
said bit line sense amplifier array composed of K bit line sense  
35 amplifiers is divided into  $2^n$ , receives  $2^n$  signals which n column

addresses are decoded and holds  $2^n$  signals decoded at every said sub column decoder in common.

5. The semiconductor memory device according to claim 1, wherein  
5 said sub column decoder is that one sub column decoder among sub column decoders connected to said bit line sense amplifier array is activated.

6. A semiconductor memory device, said device comprising:

10 a bit line sense amplifier array composed of K bit line sense amplifiers divided into  $2^n$  in a column direction;

all  $2K/2^n$  local data bus lines having said bit line sense amplifier group of the same column direction every array in common and displaced to pass over a cell array and said bit line sense  
15 amplifier array;

a sub column decoder connected to both sides of said cell array so that one bit line sense amplifier per  $2^n$  on said each bit line sense amplifier array can be connected with said local data bus line;

20 a switch means being so that said line bit sense amplifier selected by an output of said  $2^n$  sub column decoders per said each bit line sense amplifier array can be connected with said local data bus line; and

25  $2K/2^n$  data bus sense amplifiers connected to said  $2K/2^n$  local data lines to pre-read  $2K/2^n$  bit line sense amplifier data selected by said column decoder output.

7. The semiconductor memory device according to claim 6, wherein  
30 said bit line sense amplifier array composed of said K bit line sense amplifiers is divided into  $2^n$  in a column direction, n is an integral number greater than 0 or equal to 0.

8. The semiconductor memory device according to claim 6, wherein  
35 said sub column decoder are selected by a block selective signal when said bit line sense amplifier array composed of K bit line

sense amplifiers into  $2^n$ , and decodes by receiving  $n$  column addresses.

5 9. The semiconductor memory device according to claim 6, wherein said switch means is selected by a block selective signal when said bit line sense amplifier array composed of  $K$  bit line sense amplifiers is divided into  $2^n$ , receives  $2^n$  signals which  $n$  column addresses are decoded and holds  $2^n$  signals decoded each said column decoder in common.

10 10. The semiconductor memory device according to claim 6, wherein said sub column decoder is that said sub column decoder connected to both sides of said bit line sense amplifier array of a cell array to which said access word line pertains is activated.

15 11. A semiconductor memory device for performing a burst read operation for 2 continuous row addresses, said device comprising: data of said previous row addresses being preread in said data bus sense amplifier, next burst read operation being continuously  
20 performed after first burst read by performing access to data of said next row address through precharged state during a burst read operation, in order to perform a continuous burst read operation, in order to perform a continuous burst read operation without interrupting between burst data by means of a previous row address  
25 and a next row address.

30 12. A semiconductor memory device having a data bus sense amplifier array composed of  $m \times n$  data bus sense amplifiers, said device comprising: one block being divided into  $m$  data bus sense amplifier block by regarding  $n$  data bus sense amplifier holding an output of a column decoder in common as one block;  $n$  bit line sense amplifiers pertaining to said data bus sense amplifier block transferring the stored data by being simultaneously connected to  
35  $n$  global data buses by an output of said column decoder; said transferred data having a data read path transferred to a data pin

through a data output driver after it is received on a read data buffer.

5 13. A semiconductor memory device having a data bus sense amplifier array composed of  $m \times 2n$  data bus sense amplifiers, said device comprising: one block being divided into  $m$  data bus sense amplifier block by regarding  $2n$  data bus sense amplifiers holding an output of a column decoder in common as one block;  $n$  data bus sense amplifiers among  $2n$  bit line sense amplifiers pertaining to said data bus sense amplifier block transferring the stored data by being simultaneously connected to  $n$  global data buses means of the output of said column decoder and an output selector; and said transferred data comprising a data read path transferred to a data pin through a data output driver after it is received on a read data buffer.

14. The semiconductor memory device according to claim 13, wherein said two data bus sense amplifier groups of said data bus sense amplifier blocks are that one data sense amplifier group performs a burst read operation by being connected with  $n$  global data bus means of the output of said column decoder and an output selector; and other data bus sense amplifier group simultaneously performs receiving data of the  $m \times n$  bit line sense amplifiers selected by being connected to  $m \times n$  local data buses by means of the output of an input selector.

15. The semiconductor memory device according to claim 13, wherein said data bus sense amplifier block is that each data bus sense amplifier of said data bus sense amplifier block has 2 latches, one latch being connected to each data bus sense amplifier by an input selector, data sensed by said data bus sense amplifier is latched; the other latch performs a burst read operation by being connected with a global data bus by means of the output of an output selector and a column decoder.

16. The semiconductor memory device according to claim 13, wherein said data bus sense amplifier block is that each data bus sense amplifier of said data bus sense amplifier block has 4 latches, one latch among 4 latches being connected to each data bus sense amplifier by an input selector, a data sensed by said data bus sense amplifiers latched; the other latch performs a burst read operation by being connected with a global data bus by means of the output of an output selector and a column decoder.

17. A semiconductor memory device having  $m \times n$  write data drivers for  $m \times n$  local data buses, wherein  $n$  write data drivers holding an output of a column decoder in common are divided into  $m$  write data driver blocks by becoming one block,  $n$  write data drivers pertaining to said write data driver block continuously perform write operation by being simultaneously connected to a global data bus by means of the output of said column decoder and driving to a local data bus transferred through said global data bus from a data pin.



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Claims searched: 1-10

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**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4C C700B C700C C706 C800C C800E C800G C11408D C11409A  
C11409C C11409C1

Int Cl (Ed.6): G11C 7/00 7/06 8/00 11/408 11/409

Other: Online: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
P A	GB 2291233 A (HYUNDAI) 17.01.96 see Figure 2A	1 and 6
P A	US 5535172 (ALLIANCE SEMICONDUCTOR CORPORATION) 09.07.96 see 18, Figure 2 and 26, 28 Figure 3	1 and 6
A	US 4977538 (MITSUBISHI) see Figure 5	1 and 6

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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